

CLAIMS

We claim:

1. Method for producing laser-induced images with internal structure inside transparent materials, so that the internal structure is visible, comprising:

- transformation of an image into arrangement of points so that the outer laser-induced damages do not shade the internal laser-induced damages;
- modification of the said arrangement of points, so that laser-induced damages created at these points reproduce both the shapes of the separate internal fragments and their shades of gray;
- transformation of the said arrangement of points, so that laser-induced damages created at the points do not generate internal crash of the transparent material;
- controlling the brightness of the said laser-induced damages, so as to reproduce grade shades of internal structure;
- generating and focusing laser radiation at the points of the transparent material corresponding to the points of the said arrangement, so that the marks generated as a result of the interaction of laser radiation with the material are visible.

2. The method in accordance with claim 1 including transformation of an image into arrangement of points, so that internal laser-induced damages, produced at these points are visible, comprising:

- creation of point arrangement by the infill of the internal structure of an image with the points, so that their density of the each internal area corresponds to the brightness of corresponding area;
- removal of those points of the said arrangement, the distance between which is smaller than the minimal distance;
- logical removal of outer points, which shade internal points;
- correction of the gray shades of the internal areas by controlling the brightness of points belonged to the corresponding areas.

3. The method in accordance with claim 1 including the transformation of an image into arrangement of points, so that this arrangement, containing the points of identical brightness, reproduces all grade shades of the initial image.

4. The method in accordance with claim 1 including the control of the brightness of laser-induced damages by modification of their sizes.

5. The method in accordance with claim 4 including the modification of the damage sizes by controlling the level of laser energy accumulated by plasma generated by the breakdown.

6. The method in accordance with claim 4 including the modification of the damage sizes by controlling the shape and sizes of focal spot and the pulse duration.

7. The method in accordance with claim 4 including the modification of the damage sizes by controlling the temporal shape of laser pulse and its duration.

8. The method in accordance with claim 4 including the modification of the damage sizes by controlling optical system focusing laser radiation.

9. The method in accordance with claim 4 including the modification of the damage sizes by controlling the wavelength of the laser radiation.

10. Method for transformation of an image into multi-surface arrangement of points, so that points of each surface are visible through points of all other surfaces; all points reproduce gray shades of the internal structure of the image; and all points of the said multi-surface arrangement can be produced inside transparent material by using breakdown phenomenon without internal crash.

11. The method in accordance with claim 10 including creation of enclosed surfaces of arbitrary shapes for reproduction of internal structure of an image.

12. The method in accordance with claim 11 including creation of enclosed surfaces, shapes of which are similar to the outer image shape.

13. The method in accordance with claim 10 including reproduction of gray shades of an image by placing the laser-induced damages into several surfaces of arbitrary shapes so that an internal crash does not arise.

14. The method in accordance with claim 10 including creation of a point arrangement for production of portraits having desirable number of gray shades and placing onto a surface (or surfaces) of arbitrary shape.

15. Method for reproducing internal structure of tomographic image by production of arrangement of laser-induced damages inside transparent materials.

16. The method in accordance with claim 15 including creation of 3D arrangement of points reproducing internal structure of a tomographic image by combination of multi-layer arrangements describing all 2D reconstructed images.

17. The method in accordance with claim 15 including creation of 3D arrangement of points in accordance with the normalization parameter of the reconstruction method.